

# Title:« Impact of Hilltop Community Land Use/Cover Management Practices on Downstream Surface Water Quality in Migina Catchment, Southern province of Rwanda»

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TERRACES / DISPERSED SETTLEMENT



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WATER POLLUTION



# Outline

**1. Research problem**

**2. Justification**

**3. Key areas for questioning regulations on LULC in Rwanda**

**4. Objectives: Overall & Specific o.**

**5. Conceptual Framework**

**6. Methodology & Research design**

**7. Expected results**

**8. Research progress and encountered difficulties**

**WATER QUALITY MONITORING**

**ERROSION/ LAND SLIDES/ RIVER BANK DEGRADATION**



# Research problem (1)

As reported in «[National Risk Atlas of Rwanda, 2015](#) » significant effects observed on downstream surface water quantity and quality are related to:

- ❖ ( i ) Water Sanitation ,
- ❖ (ii) Water Supply and
- ❖ (iii) high Water Treatment costs due to nutrients and sediments loaded by erosion, land slide and floods ([MIDIMAR,2015](#)).
  
- ❖ Despite efforts done in formulating , enacting and promulgating laws and policies on natural resources managements, Rwanda is experiencing a significant conversion of natural forest and grassland to cropland and built-up areas ([Karamage et al., 2017](#)), therefore water quality is still degrading.
  
- ❖ From 1990–2016, 64.5% of forest and 32.1% of grassland covers were converted into cropland and built-up areas.



# Research problem (2)

- ❖ In the Migina catchment, several studies have reported that hydrological cycle of the areas has been affected by growing settlement and possible climate change ([Gatwaza, 2016](#); [Munyaneza, 2014](#)).
- ❖ However, there is limited information about the interrelationship between land use and water quality in the catchment (deforestation, grouped settlements releasing wastes, erosion due to non protected slopes and non protected river banks, etc...).
- ❖ This information is very important for designing sustainable Management Plan for the catchment.
- ❖ It requires an appropriated study to identify suitable areas for settlement and any other infrastructure with minimum loading in water or to identify the best management practices for pollution control.
- ❖ The areas to be targeted for pollution control are likely growing settlement including schools, prisons, markets, hospital, etc.



# HACH- HQ<sub>40d</sub> MULTI PARAMETER ANALYSIS

**TWICE /MONTH**

**1. PH**

**2. T o**

**3. Conductivity**

**4. ORP**

**5. TDS :**

**6. DO**

**7. GIS COORDINATES**

**8. WATER LEVEL**

**9. WATER FLOW**

**10. BOD<sub>5</sub>**

**11. COD**

**12. TP**

**13. TN**

**14. NH<sup>+</sup><sub>4</sub>**

**15. NO<sup>-</sup><sub>2</sub>**

**16. NO<sup>-</sup><sub>3</sub>**

**1. KIHENE**

**2. MUKURA**

**3. GASENYI**

**4. KAGERA**

**5. RWABISE  
MANYI**

**6. NYARUTE  
JA**



# Justification (1)

- ❖ For researchers, understanding the local people's perceptions on environmental issues is a prerequisite in making successful and sustainable resource management strategies (Achamyeleh, 2015; Tesfaye et al., 2014; Alemayehu et al., 2013).
- ❖ So, the significance of this study for scientists is mainly based to findings from settled objectives, as social and technical tools to investigate and prevent the factors that may compromise the implementation of land use/cover laws and regulations with regards to impact on water quality;
- ❖ This research will contribute to farmers in providing skills on how to use the natural resources efficiently in a sustainable way without compromising future generations. Innovations for management protocols should be suitable to local people, simple to use and maintain, and inexpensive to implement.
- ❖ The output for policymakers, development practitioners and extension's workers is to be skilled in order to inform the catchment stakeholders to make wise decisions regarding land use, land cover and waste management.

## for land use/ cover and waste management

1.Sahera

2.Mbeho

3. Kansi

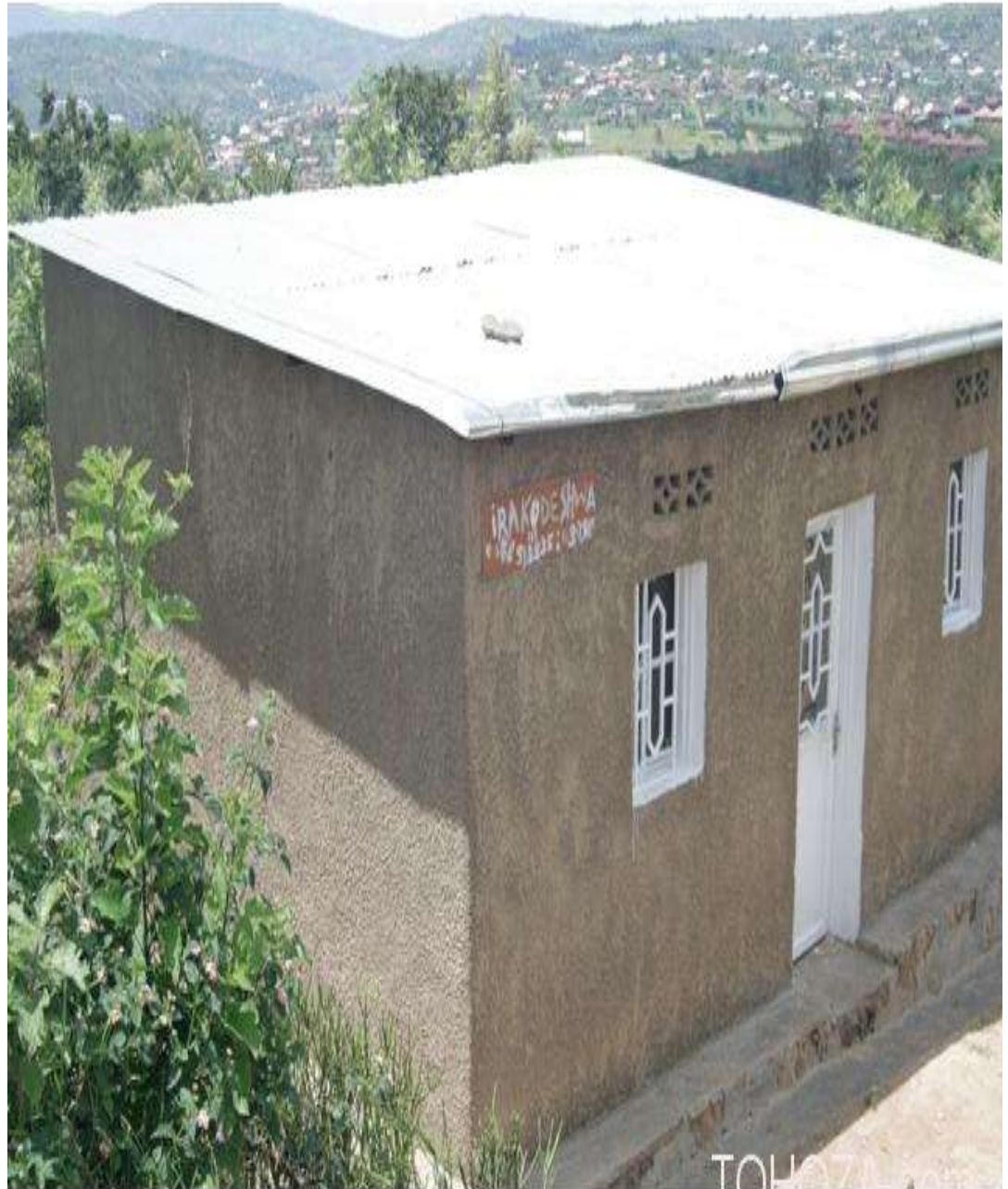
4.Rwabise

5.'Kagera

6.Nyaruteja

Survey in growing settlements, parishes, schools, markets and health centers :

- Farmer's : perception and compliance with LULC regulations and policies (including waste management)
- Strengths, weaknesses, opportunities and threats of regulations and policies implementation





# KEY AREAS FOR QUESTIONING REGULATIONS ON LULC IN RWANDA

1. Trees plantation
2. Use of terraces
3. River bank protection ( by protecting vegetation or hydraulic structures)
4. Renewable energy as bottled methane gas and use of biogas,
5. Improved stove,
6. Appropriated septic tank for human and animal waste household
7. Waste management (WRRR: Waste Reduce, Reuse and Recycle) including waste collection,
8. Rain water harvesting
9. Family Planning
10. Use of manure and compost + Moderate and regulate the use of pesticides and fertilizers



# Objectives (1)

## Overall objective

To evaluate the impact of community land use/ cover management on water quality at district and catchment level.

## Specific objectives

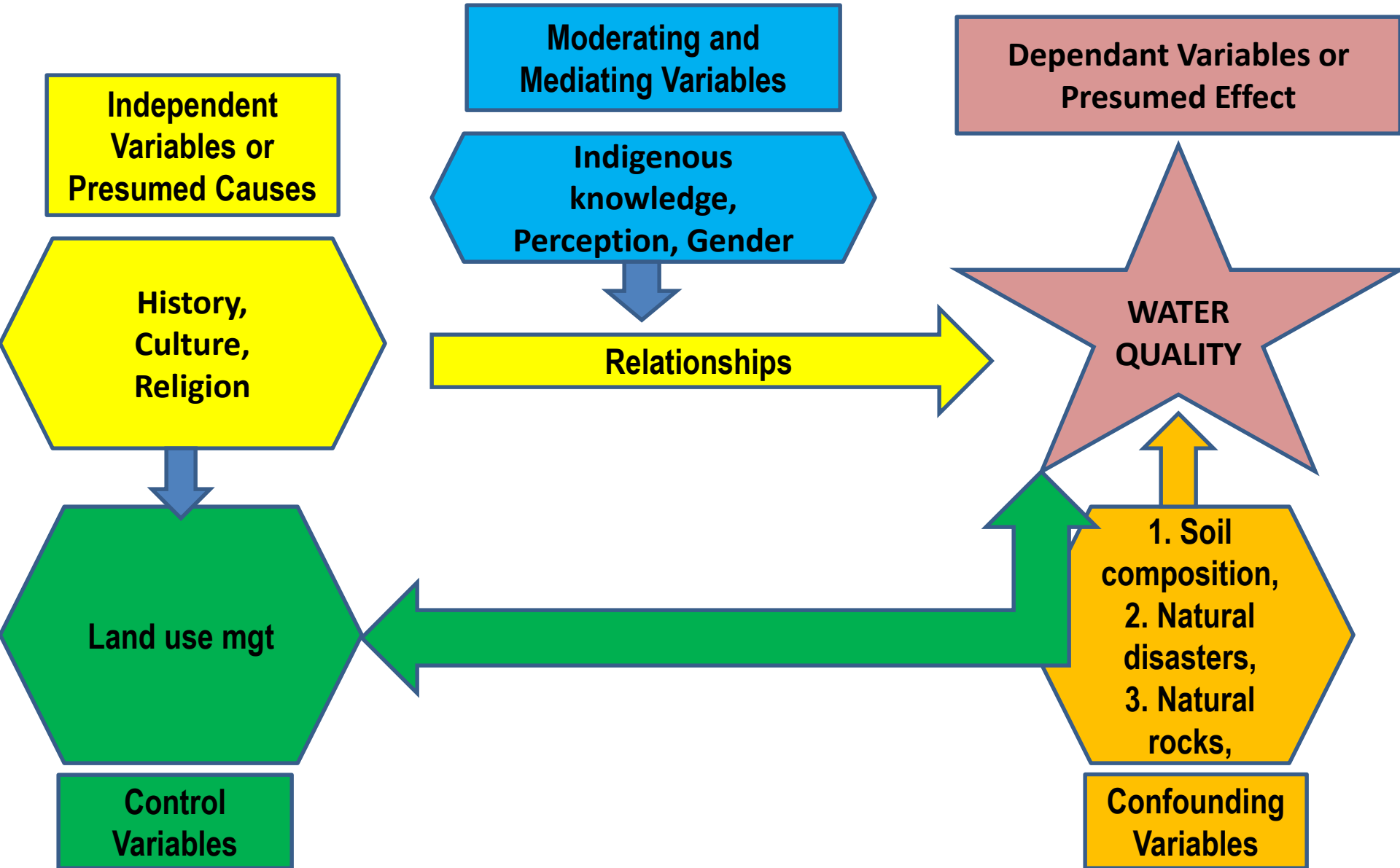
- ❖ To analyze the farmer's perception and compliance of land use/ cover management practices with regulations regarding the impact on water quality;
- ❖ To identify the strengths, weaknesses, opportunities and threats of regulations on land use/cover management for surface water pollution prevention options;
- ❖ To determine the pollution hot-spots with potential to compromise surface water quality;
- ❖ To determine the effect of land use/cover management practices on surface water quality; (Reference to objective 1, 2, and 3)

# Research questions

- ❖ What is the extent of farmer's perception and awareness on LULC and waste management practices? Are there practices from indigenous knowledge, cultural and spiritual which add to LULC and waste management practices issue?
- ❖ What are the key barriers that make farmers sometimes do the contrary in practices of regulations for land use and water (Financial, education, culture.... etc)?
- ❖ What are the pollution hot spots, transport pathways and environmental fate of sediments and waste?
- ❖ Are there any land use/ cover management protocols for water quality prevention that ensure they are more suitable to local farmers, simple to use, to maintain and inexpensive to implement?

# Conceptual Framework; reference to John Latham, 2005

Main components and concepts to be used. Research orientation towards specific sets of research questions. Working strategy for this study. Reference to the logical framework prepared by John Latham, 2005



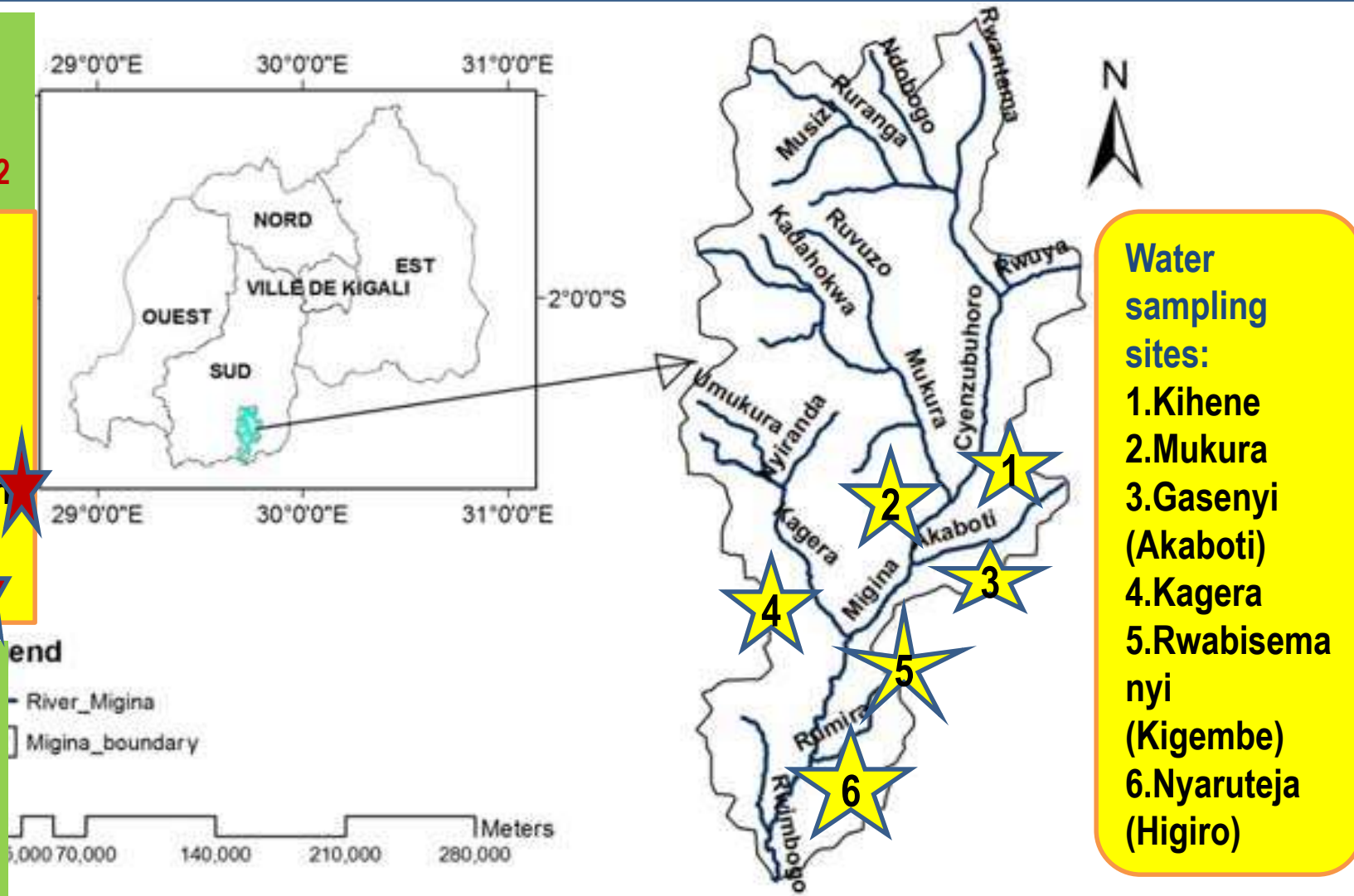
# Methodology: Study area, Rwanda, Migina catchment

**Fig 2: Location of the Migina catchment in Rwanda and its river network**

**Area of Rwanda:**  
**26,338 km<sup>2</sup>**

Farmer's survey sites:  
1. Sahera,  
2. Mbeho,  
3. Kansi,  
4. Rwabisemanyi,  
5. Nyaruteja.

**Area of Migina Catchment:**  
**260 km<sup>2</sup>**





# Study area, Rwanda, Migina catchment

- ❖ Migina catchment located between latitudes 2°32' to 2°48' South and longitudes 29°40' to 29°48' East, in southern part of Rwanda.
- ❖ The Migina catchment is one of the Rwandan sub-catchments of the Kagera River basin with an area of around 260 km<sup>2</sup> with a growth population rate of about 3%; (Van den Berg and Bolt, 2010).
- ❖ The main rivers draining Migina area are: Munyazi-Rwabuye, Mukura, Cyihene-Kansi and Akagera. The Migina River is a tributary of Akanyaru River which serves as a border between Rwanda and Burundi. Akanyaru River meets with Nyabarongo and becomes the Kagera River which is the largest tributary of Lake Victoria (discharge point in Uganda), and it is also called the source of river Nile (NELSAP, 2007).
- ❖ Akagera is a precursor of the Nile River.



# Methodology & Research design

SPECIFIC OBJECTIVE	Approach	Data source	Tool	methods	Data analysis
Farmer's perception and compliance with LULC regulations	•Quantitative •Qualitative /Case study .	•Farmers •Extension workers •Local administrative staff •Land use characteristics	•FG guide •Questionnaire	PAR: Participatory Rural Apraisal (Pairwise ranking: Transect walk to complete	Descriptive statistics : Mean, Chi square to compare) FGD , SPSS 17.0, +
2: Strengths, weaknesses, opportunities and threats of regulation s implementation	•Quantitative •Qualitative /Case study .	•Farmers •Extension workers •Local administrative staff •Land use characteristics	•FGD guide •Questionnaire	•SWOT-AHP Analysis,  •Analytic Hierarchy Process (AHP),  •Expert Choice version 11.5 software	SWOT+ AHP Analysis + Software Expert Choice version 11.5 - <a href="#">Making paire wise comparison Matrix</a> , checking consistency
3 : Pollution hot-spots	•Quantitative •Qualitative /Case study .	•Farmers •Extension workers •Local administrative staff •Pollution hot- spots •Land use characteristics	•Descriptive observations of non-verbal behavior. •High and complete (Level) observation Time-interval observation  •Arc SWAT software	•Participant Structured Observation (type) •Direct observation And ArcSWAT software as tool	•Content analysis for qualitative •Descriptive statistics : Mean, Anova, Chi square to compare) •Arc SWAT software •SPSS 17.0
4: Effect of LULC impact on surface water quality.	•Quantitative •Qualitative /Case study .	•Farmers •Extension workers •Local administrative staff •Land use characteristics	•Tools used in specific objective 1,2, and 3 , •Arc SWAT software	Findings in 1+2+3 + predictions by Arc SWAT, Lab analysis	Arc SWAT software Lab analysis (Descriptive statistics : Mean, Anova, Chi square to compare)

# Expected results of this study

**4 published papers in peer reviewed journals.**

- ❖ The perception and compliance and of farmer's land use/ cover management with regulations regarding the impact on water quality;
- ❖ SWOT-AHP (SWOT- Analytic Hierarchy Process: AHP) analysis of regulations on land use/cover management for surface water pollution prevention options;
- ❖ Pollution hot-spots with potential to compromise surface water quality;
- ❖ Effect of land use/cover management practices on surface water quality;
- **Including that:** Land use/cover and waste management recommendations and protocols will be available, suitable to local population, simple to use and maintain, and inexpensive to implement.

# RESEARCH PROGRESS AND ENCOUNTERED DIFFICULTIES

No.	Activity	Timeline	Remark
1.	<ul style="list-style-type: none"> <li>• Coursework</li> </ul>	Year 1	Very good progress
2.	<ul style="list-style-type: none"> <li>• Strike and closing Makerere University</li> <li>• PhD Research proposal development.</li> <li>• Remaining courses and Recommended Short trainings</li> </ul>	Year 2	<p><u>Financial issues</u></p> <ul style="list-style-type: none"> <li>• Receiving University: Makerere University: Accommodation + office space and fee waiver.</li> <li>• Sending university : University of Rwanda: Air ticket + Stipend for living allowance at Makerere University.</li> </ul>
3	<ul style="list-style-type: none"> <li>•Field research and data collection.</li> <li>PhD data analysis</li> <li>PhD thesis writing</li> <li>PhD thesis pre-defense and defense</li> </ul>	Year 3 extendable to year 4	<ul style="list-style-type: none"> <li>•RUFORUM: Research grant for social part.</li> <li>•Any other research grant: for Lab Analysis part (Age limit for some grants: Less than 40, gender)</li> </ul>





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